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STUDIES IN THE MELYRIDÆ NO. 6

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Recent studies in the genus *Trichochrous* shows very clearly that the *conformis* of LeConte is not identical with *suturalis* LeConte, as suggested by Casey. I have before me a large series of *suturalis* collected at San Diego, California, during the late eighties and early nineties, and a recently collected series of *conformis* taken on the Laguna and Cuyamaca Mountains of San Diego County. My series of *suturalis* was passed on by Colonel Casey. This species has never been adequately described, for it stands almost unique in the development of the humeral angles and basal angles of the pronotum, especially in the more strongly developed individuals. The salient differences between the two species can best be stated as follows:

Suturalis Lec. More robust, head and prothorax relatively large (male), basal angles of the pronotum explanate, strongly chitinized, distinctly rectangular to subacute and more or less prominent laterally; humeral angles likewise explanate and rectangular to prominent laterally, adapted to the pronotal basal angles. A line of white hairs, varying in width, along the sutural margins from about the scutellum to the elytral apex; whitish hairs on the deflexed sides of the elytra and gradually scattering on the disk and apical area. In the male the elytra are gradually narrowed behind from the base. The humeral and basal angles in the female are quite like those of the male and the former sex differs, as LeConte says, in having the sides of the elytra parallel. In both sexes the pronotum is narrowed anteriorly and more or less sinuate before the basal angles.

Conformis Lec. Less robust, parallel and more elongate. Humeral and pronotal basal angles never as strongly developed as in *suturalis*. The angles usually obtusely rounded and therefore not explanate or subacutely prominent laterally. Cinereous hairs arranged about as in *suturalis*, except that the sutural line is feebler or absent, the marginal line being heavier and better defined. The sides of the pronotum are more arcuate, less convergent anteriorly and less sinuate posteriorly. Color intense black and shining, while in *suturalis* it is duller. The two species are quite closely related.

The present opportunity is taken to describe two new species as follows:

Trichochrous albertensis Blaisdell, new species

Form oblong-oval, sides of pronotum and head noticeably convergent anteriorly, moderately convex, a little more than twice as long as wide. Color black; legs clear rufo-testaceous; antennæ pale toward base, distal joints more or less piceous, basal joint black; mouth-parts more or less pale. Luster shining.

Pubescence not dense, not completely hiding the general surface, short and recumbent, without erect hairs; color flavo-cinereous. Lateral pronotal fimbriæ short, regular and cinereous; lateral elytral fringe a little longer, less close, regular and also pale. Hairs of the under surface of body a little longer and recumbent.

Head moderate in size, across the eyes very little wider than the pronotal apex, about as long as wide; front slightly and broadly impressed between the eyes, punctures small, distinct and in the central area separated by a distance equal to two or three times their diameter; surface more or less finely rugulose, with a slightly convex and glabrous area at middle against the epistomal base. Eyes moderate in size and moderately convex. Antennæ short, extending to about basal third of the pronotum.

Pronotum about a fourth wider than long, moderately convex; apex feebly arcuate to truncate in feeble circular arc; sides moderately and evenly arcuate in basal half, thence anteriorly nearly straight and convergent to apex, apical angles moderately broadly rounded; base broadly and moderately arcuate, continuously so with the sides, basal angles completely obsolete; disk noticeably more strongly declivous and very feebly compressed antero-laterally; very sparsely punctate, punctures well defined and rather small, separated by a distance equal to three or four times their diameter, interstitial surface smooth to the margins.

Elytra oblong, scarcely twice as long as wide, quite evenly convex from side to side; base transverse, scutellum transverse and densely clothed with fine pale hairs; humeri moderately rounded, very feebly tumid; sides parallel, not arcuate; apex broadly but not strongly rounded from middle third, margins narrowly and distinctly explanate from just behind the humeri, broadening apically into the general surface of apex; surface feebly undulate, punctures about same size as those of the pronotum becoming finer on the apex.

Abdomen extremely finely punctato-rugulose. Legs rather slender, the anterior and middle noticeably shorter than the posterior.

Male, the only sex at hand, has the fifth ventral abdominal segment truncate at apex, scarcely feebly sinuate.

Measurements. Length, 3 mm.; width, 1.2 mm.

Holotype, male, and one paratype of same sex in my own collection. Other paratypes in the collection of Mr. F. S. Carr, of Medicine Hat, Alberta, Canada. Collected by Mr. Carr on June 26, 1924.

Type locality. Medicine Hat, Alberta, Canada.

Albertensis is to precede *simulans* Casey according to Casey's table. It differs from that species by the shorter antennæ, more strongly convergent sides of the pronotum, narrowly explanate sides of the elytra which is noticeable when viewed from above, sparsely punctate pronotal disk and shorter lateral pronotal fimbriæ. *Simulans* Casey occurs at El Paso, Texas. My single male specimen is from Fort Bliss, Texas. *Modestus* Casey has pale elytra and is found in Kansas. I have several closely related and undescribed species. A generic revision of the Melyridæ is under way.

***Trichochrous fieldii* Blaisdell, new species**

Form parallel oblong-oval, moderately convex, pronotum noticeably narrower than the elytral base. Color black; antennal base and mouth-parts sometimes piceous; femora piceous, basal articulations more or less rufous; tibiæ and tarsi rufous, the former at base and terminal joint of tarsi blackish. Luster shining, pronotal disk especially so; in bright light somewhat æneous.

Pubescence short, recumbent, rather sparse and not hiding the general color of the surface; color ashy-gray. Pronotal lateral fimbriæ pale, equal in length and moderately short, closely placed; those of the elytral margins rather short and more widely spaced. On the under surface of the body the hairs are recumbent and rather short; finer on the head.

Head not wider than the pronotal apex, muzzle of moderate length. Eyes moderately prominent, not coarsely faceted. Front not convex, sparsely and rather finely punctate, punctures somewhat larger and slightly denser laterally and the surface feebly rugulose, behind the epistomal base the surface is quite glabrous; vertex and occiput more strongly punctate. Antennæ rather slender, not serrate anteriorly, very gradually and rather feebly incrassate distally; third joint obconical, noticeably elongate; joints 4-10 subtriangular, fifth distinctly triangular and slightly larger than the contiguous joints.

Pronotum about a third wider than long, apex subtruncate, scarcely narrower than the base; sides moderately arcuate, feebly subangulate at basal third, arcuately convergent anteriorly and rounding broadly into the arcuate base, basal angles absent; apical angles obtusely rounded and not in the least prominent anteriorly; disk moderately convex, sparsely punctate in the central area; punctures moderate, not impressed and separated by a distance equal to two or three times their diameter, laterally punctato-reticulate sometimes rather broadly so, interstitial surface of the central area glabrous and polished.

Elytra a little more than twice as long as the pronotum and less than twice as long as wide; base emarginate, humeri rather narrowly rounded, umbones moderate; sides parallel, very feebly arcuate, somewhat gradually rounded at apex, sutural angles rounded, slightly dehiscent; disk slightly flattened centrally and toward base, evenly

and arcuately declivous laterally, abruptly so at humeri. Punctures not dense, fine, separated by a distance equal to two or three times their own diameter; surface extremely finely rugulose. Abdomen finely punctate, surface very finely and more or less transversely rugulose.

Male, the only sex studied. Fifth ventral segment truncate at apex. Lateral spurs of the anterior and middle tibiae thickened. Both spurs of the hind tibiae equal in size and slightly robust.

Measurements. (Type) length, 3.2 mm.; width, 1.2 mm. Described from six males, the smallest measured, length, 2.8 mm.; width, 1 mm.

Type locality. Rainbow, northern part of San Diego County a short distance south of the county line from Riverside County. One specimen was collected at Ethanac in Riverside County some thirty miles directly north of Rainbow. Specimens collected on April 9, 1926, by Mr. George H. Field.

Holotype, a male, which, with paratypes, is deposited in the collection of the California Academy of Sciences. Paratypes are also placed in Mr. Field's collection at San Diego.

Fieldii appears to be most closely related to *fulvotarsis* Bland, from which it differs in the more elongate elytra, shorter and sparser pubescence, longer, more slender and not serrate antennae, as well as in the more prolonged muzzle. *Fulvotarsis* occurs on the blossoms of *Grindelia* in the vicinity of east Oakland, Alameda County, California.

***Listrus medicatus* Blaisdell, new species**

Form elongate-oval, slightly narrowed anteriorly, moderately convex. Color black; distal portion of tibiae and tarsi piceous. Luster shining.

Pubescence short and recumbent, moderately dense and plumbeo-cinereous in color with distinct maculae and a vitta of black hairs arranged as follows: Four basal spots, humeral and juxta-scutellar, the latter not confluent across the suture, the former smaller; post-basal, at middle of each elytron, of moderate size; submedian fascia well formed, transverse, interrupted at suture, not quite attaining the lateral margins, anterior margin irregular; subapical row of four maculae, each nearer to suture and lateral margin than to each other; apical macule of moderate size on each elytron. Pronotal central macule hour-glass-shaped, scarcely subdivided apically and basally; lateral vittae broken into two small spots or somewhat obsolete. Lateral fimbriae short and pale. Hairs of the body beneath not dense or long, and similar in color.

Head moderate in size, about as long as wide, muzzle quite short, sides of the front converging rapidly before the eyes. Front feebly and widely impressed, punctures small, well defined, in the central area separated by a distance equal to two or three times their

diameter, denser toward epistomal base and sides of front before the eyes; vertex and tempora densely asperato-punctate; a very small glabrous, slightly convex callus against middle of the epistomal base. Eyes moderately large, very convex and prominent. Antennæ of moderate stoutness, very feebly incrassate and moderately compressed; second joint oval and very slightly longer than wide; third subcylindrical to obconical, fourth feebly triangulo-obconical, fifth noticeably subtriangular and a little wider than the preceding and following joints; sixth to the ninth inclusive similar in form, slightly triangular, ninth slightly more robust, tenth as long as wide and slightly stouter than the ninth; eleventh about twice as long as wide and narrowed apically.

Pronotum slightly wider than long, widest a little behind the middle, strongly convex; apex arcuato-truncate in circular arc; sides moderately strongly arcuate posteriorly, less so, straighter and convergent in front of the middle, serrulations small; angles rounded, base broadly arcuate and rounding into the sides, basal angles represented by a larger serrule; disk noticeably declivous antero-laterally, moderately densely indentato-punctate laterally and less so along base; intervals of the central area flat and smooth, in part feebly indented at times, punctures separated by a distance equal to one or two times their diameter.

Elytra about twice as long as wide; humeri well rounded, not tumid or very feebly so; base transverse; disk with punctures well separated, finer apically, surface slightly undulate basally.

Legs rather slender and of moderate length.

Male. More parallel and less broadened posteriorly, sides of elytra scarcely arcuate; fifth ventral not modified on the surface, evenly and distinctly sinuate at apex. Female broader, sides of elytra noticeably arcuate; antennæ rather slender, joints slightly more elongate; fifth ventral rounded at apex, but not strongly so, apical margin very feebly deflexed.

Measurements. (Types) length, 3-3.4 mm.; width, 1.1-1.3 mm.

Holotype, male, and allotype, female, and a male paratype in my collection; other paratypes in the collection of Mr. F. S. Carr. Collected by Mr. Carr on May 11, 1924.

Type locality. Medicine Hat, Alberta, Canada.

Medicatus is to be more particularly separated from *provincialis* Blais. The latter is less elongate, smaller in size and the elytral pattern is not so strongly developed. In *provincialis*, also, the outer joints of the antennæ are more incrassate, the prothorax is relatively larger, and the fifth ventral segment at apex is more asperate. The type of maculation may be similar in both species when extreme; in *provincialis*, however, it is usually less strongly defined.

82 A SHORT REVIEW OF THE TRIBES ORSODACNINI
AND CRIOCERINI OF THE COLEOPTEROUS
FAMILY CHRYSOMELIDÆ WITH SPE-
CIAL REFERENCE TO SPECIES OF
WESTERN UNITED STATES

BY HAROLD R. BRISLEY

TRIBE ORSODACNINI

This tribe embraces four genera, all of which are well represented in western United States. In 1873 G. R. Crotch¹ the genus *Syneta*. He also described the one species of the genus *Orsodacna* and gave a short table of the species of *Zeugophora*, but omitted the species *Tricolema anomala* Cr., which had been described eighteen years before. Since 1892 no systematic work has been published treating of the tribe.

The tables constructed by the above mentioned authors, for separation of genera and species, were evidently based on relatively small series, and after a detailed study of characters available for use in separation, I have constructed the tables given below which I am satisfied can be used with much greater precision. Crotch based the separation of genera on the characters of prothoracic dentation and open or closed anterior coxal cavities, good characters at that time, but the former, at least, was reduced to little value upon the introduction of the genus *Tricolema*. LeConte and Horn use as their main characters the separation and prominence of the anterior coxæ and the shape of the sides of the prothorax. These characters are merely relative and can be used with precision only when comparative specimens are at hand. With the presence of more definitely reviewed the genera *Orsodacna*, *Syneta* and *Zeugophora*, including in them twelve species known at that time. A year later² he described a new genus *Tricolema* to make a place for the new species *T. anomala* Cr. In 1883 LeConte and Horn³ classified the four genera mentioned above under the tribal name of *Sagrini*. In 1892 G. R. Horn⁴ discussed at some length nite characters, these can better be used as secondary divisional points.

¹ Proc. Acad. Nat. Sci. Phila., Vol. 25, 1873, pp. 19-83.

² Trans. Am. Ent. Soc., Vol. 5, 1874, pp. 73-80.

³ "Classification of the Coleoptera of North America." Smith. Misc. Coll., Vol. 26, 1883.

⁴ Trans. Am. Ent. Soc., Vol. 19, January, 1892, p. 1.

It might be well to explain the limitations of the serial arrangement of the punctuation in the genus *Syneta*. This is usually definite, but in large series some females may be found where this character cannot be readily applied. In a case of this kind, if the characters of the open front coxal cavities and the lateral prothoracic dentation are used, no error can result.

KEY TO THE GENERA OF THE TRIBE ORSODACNINI

- A. Elytral punctuation at least in part serially arranged; body sparingly pubescent; front coxal cavities open behind; sides of prothorax dentate.....3. *Syneta* Lec.
- AA. Elytral punctuation entirely confused.
 - B. Upper surface densely clothed with long decumbent pubescence.....2. *Tricolema* Cr.
 - BB. Upper surface either destitute of pubescence or with a single erect seta in each puncture.
 - C. Prothorax somewhat bell-shaped, the sides evenly rounded without lateral teeth or tubercles.....1. *Orsodacna* Latr.
 - CC. Prothorax with the sides toothed or tuberculate.
 - 4. *Zeugophora* Kunze

Genus ORSODACNA Latr.

This genus contains a single, widely distributed species, whose color is so variable that it has been described under ten different names. These were later reduced to six varieties of the species *Orsodacna atra* (Ahr.). A recent key to the color varieties of this species is given by W. S. Blatchley in his "Illustrated Descriptive Catalogue of the Coleoptera Known to Occur in Indiana." The species is distributed throughout the eastern United States, and in the territory west of the Rocky Mountains has been taken in Montana, Colorado, Arizona, Utah, California and Oregon. Adults are usually found on willows in the spring of the year.

Genus TRICOLEMA Cr.

In 1874 G. R. Crotch described the genus *Tricolema*¹ from the new species *anomala*, which he also describes in the same paper. His generic description follows:

"Elongate, nearly parallel, pubescent, eyes small, head not constricted behind, anterior coxæ contiguous, first joint of the anterior four tarsi longer than the others, claws simple, epipleuræ of elytra excessively feeble."

¹ Trans. Am. Ent. Soc., Vol. 5, 1874, p. 79.

LeConte and Horn² recognized this genus and included in it the single species *anomala*. Clavareau³ and Leng⁴ both suppressed it to a subgenus under *Syneta*, evidently doing this on the assumption that the Crotch generic description did not state sufficient characters to warrant its generic rank.

After a close study of the group, I am convinced that *T. anomala* shows characters which are more than sufficient to justify its being placed in a separate genus. I am, therefore, revising the genus *Tricolema*, as described by Crotch, and placing in it the single species *T. anomala*.

It will be noted in the original description Crotch states that the claws are simple. The specimens at hand, which belong to the collection of Dr. E. C. Van Dyke, have been compared with the Crotch types, and the claws, though simple in the females, are distinctly cleft in the males. His two generic characters, the pubescence and the excessively feeble elytral epipleuræ, are, therefore, the only two characters which would serve to distinguish the genus from *Syneta*. As will be noted in the following revision, there are other good and valuable generic characters which fully justify its generic standing.

Revised description of genus *TRICOLEMA* Cr.

Elongate, subcylindrical, entire body above and below including the legs covered with long, dense, whitish pubescence.

Head laterally narrowed behind the eyes, not so dorsally, densely and deeply punctate, median longitudinal ridge more or less indicated by lack of punctuation; antennæ filiform, one-half to three-fourths the length of body, second segment short, about one-half the length of third.

Prothorax cylindrical, without lateral margins, coarsely punctate, distinctly widened at middle and subangulate laterally, the angulation more or less concealed by the pubescence, anterior and posterior angles distinctly prominent.

Elytra convex, the sides perpendicular or slightly incurved below the sides of the abdominal segments, epipleuræ excessively feeble, punctuation coarse, dense and confused, often largely concealed by the pubescence; a single prominent costa extends back from the umbone and is lost just before the apex,

² "Classification of the Coleoptera of North America." Smith. Misc. Coll., Vol. 24, 1883, p. 338.

³ W. Junk, "Coleopterorum Catalogus," Pars. 51, p. 36.

⁴ "Catalogue of the Coleoptera of Am., North of Mex."

while traces of two other costæ are sometimes indicated on the disk near the base.

Legs moderately long and slender; anterior coxæ contiguous, open behind, the prosternum narrowed to a mere blade between them, and posteriorly unattached; middle and posterior coxæ narrowly separated; apices of all the tibiæ fimbriate, entirely lacking terminal spines; tarsal claws of male cleft, of female simple; fifth ventral segment of male flattened and greatly elongated at middle, crowding segments two, three and four together into a space about one-half its length (Fig. 2); fifth ventral of female normal (Fig. 3).

The only genera with which *Tricolema* might be confused are *Syneta* and *Orsodacna*. It is distinct from *Syneta* by a number of characters, the most outstanding of which are:

1. The feeble epipleuræ.
2. The pubescence and confused punctuation.
3. The simple tarsal claws of the female.
4. The elongated fifth ventral segment of the male.
5. The subangulate sides of the prothorax.

Tricolema may be separated from *Orsodacna* by:

1. The open anterior coxal cavities.
2. The feeble character of the epipleuræ.
3. The pubescence of the upper surface.
4. The lack of terminal tibial spines.
5. The laterally subangulate prothorax and prominent prothoracic angles.

Until more species of this genus are found, its most logical place is between *Orsodacna* and *Syneta*, though on account of its diverse characters, its placement there is questionable.

The genus is composed of a single species *Tricolema anomala* Cr., which has been collected only in California. The insects I studied were from the following localities:

Atwood's Mill, Tulare County, Calif., April 29, 1913 (1 specimen);

Carrville, Trinity County, Calif., April 29, 1913, (1 specimen);

Muir Woods, Marin County, Calif., May 9, 1920 (7 specimens);

Lagunitas, Marin County, Calif., April 29, 1908 (3 specimens);

Placer County, Calif. (no date), (4 specimens);

McCloud, Calif., June 26, 1914 (1 specimen);

South Fork, Kings River Canyon, Fresno County, Calif., altitude 5000 feet, July 4, 1910 (1 specimen);

Meadow Valley, Plumas County, Calif., altitude 4000 feet, June 7, 1924 (2 specimens).

Genus SYNETA Lac.

In 1892 George R. Horn⁵ published the results of his study of the genus *Syneta* Lac. In the text, as well as in the illustrations, he made the error of confusing the species *S. hamata* and *S. simplex*. The following year⁶ he published a note correcting this mistake. On account of this error his published table contains only four instead of five species. He based his division of species primarily on the form of the antennæ. A quotation from his article follows:

"Several important facts have been learned. The first is, that the characters heretofore used in separation of the species based on color, sculpture, and the mode of dentation of the sides of the thorax, have an extremely small value. The second is, that the form of the antennæ, together with the sexual peculiarities of the male, afford the only means of specific definition."

There is no doubt that these characters were an improvement over those formerly used, but even the Horn characters will be found very confusing in practice. In his search for characters, he evidently overlooked the very useful one of the presence of one or two terminal spurs on the posterior tibiæ. In his description of species he mentions the terminal spurs only in connection with *S. simplex* (corrected to read *S. hamata*), *S. ferruginea* and *S. albida*, but made no mention as to whether they were single or double. After a study of large series, this character proves to be a very valuable one, and can be used with absolute precision where the specimens are reasonably clean and well preserved.

The species *S. albida* Lec. and *S. simplex* Lec. have been much confused in collections, due mainly to their imperfect and brief descriptions. During recent years Dr. E. C. Van Dyke has successfully straightened out these two species in the collection of the California Academy of Sciences. As he has never published his observations on these species, I am using characters which he found valuable for separation.

The females may readily be distinguished by the deep semi-circular, fimbriate depression of the last ventral segment. In the males this segment is simple, and either truncate or slightly elongated posteriorly. The genus *Syneta* embraces five species, four of which are common to western United States.

⁵ Trans. Am. Ent. Soc., Vol. 19, January 1892, pp. 1-5.

⁶ Trans. Am. Ent. Soc., Vol. 20, April, 1893, p. 133.

KEY TO THE WESTERN SPECIES OF THE GENUS *SYNETA* LAC.

- A. Posterior tibiæ either ramified at apex (male of *hamata*) or with two piceous terminal spurs; antennæ with segments four to ten very nearly equal in length.
 - B. Posterior tibiæ of male simple; outer segments of antennæ usually piceous or black.....1. *carinata* Mann.
 - BB. Posterior tibiæ of male ramified at tip (Fig. 1); outer segments of antennæ usually ferrugineous.....
 - 2. *hamata* Horn
- AA. Posterior tibiæ with only one piceous terminal spur; antennæ with segments eight to eleven nearly equal in length and obviously shorter than those preceding.
 - C. Space between antennæ subequal to the space from eye to antenna; elytra with only a few short, stiff hairs.
 - 3. *albida* Lec.
 - CC. Space between antennæ decidedly greater than space from eye to antenna; elytra with numerous long, stiff hairs.....4. *simplex* Lec.

SYNETA CARINATA Mann.

The species may be readily recognized by the use of the above table. Specimens have been taken from Alaska, Idaho, Utah, Oregon, Washington, and northern California. The native fir (*Abies*) is the preferred food plant of the species.

SYNETA HAMATA Horn

This species is easily distinguished, if males are at hand, by the unusual shape of the posterior tibiæ, which is prolonged on the inner edge beyond the insertion of the tarsi, and has a long, curved process on the posterior edge near the tip (Fig. 1). The apex of the tibiæ has two terminal spurs in the female. These are entirely lacking in the male. Specimens have been taken in Alaska, Washington, Oregon, and northern California. Its principal food plant is the Oregon vine maple (*Acer cercinatum* Pursh.).

SYNETA ALBIDA Lec.

This species is closely related to *S. simplex*, and heretofore adequate divisional points have not been noted in the literature. In addition to the characters given in the key, *S. albida* differs from *S. simplex* in having the frontal space between the antennæ more conspicuously raised above the level of the front. The prothorax is more rugose and less severely angulate at the

sides. The punctuation of the elytra is more regularly arranged. *S. albida* is distinct from *S. carinata* and *S. hamata* by having only a single spur at the apex of the hind tibiæ, and by the comparative lengths of the last four antennial segments with those preceding.

The species is entirely western in its distribution, being taken only in Washington, Oregon, and northern California. It is the economic species of the genus for the adults feed on the leaves of plum, cherry, pear, peach, quince, currants, etc. Willow is probably the native food plant. The larvæ feed underground, very likely gaining their sustenance from the rootlets of the above mentioned plants.

SYNETA SIMPLEX Lec.

The confusion of this species and *S. albida* in collections is due to imperfect and brief original descriptions and to lack of intensive work on the genus. By application of the characters given in the preceding key, the two species can readily be separated. In addition, it will be observed that the frontal space between the antennæ is not as conspicuously raised above the level of the front, the prothorax is less rugose and more strongly angulate, and the punctuation of the elytra is less regularly arranged in *S. simplex* than in *S. albida*. *S. simplex* differs from *S. carinata* and *S. hamata* by having only a single terminal spur on the hind tibiæ.

The species is limited to the Pacific Northwest, having only been taken in Washington, Oregon, and California as far south as the San Francisco Bay region. The adults feed on the foliage of oak.

Syneta simplex minuta Brisley, n. var.

This variety differs from the typical *simplex* mainly in size, being conspicuously smaller. Specimens of a large series at the California Academy of Sciences measure 4 to 6 mm. in length for the variety, while typical *simplex* ranges from 6 to 8 mm. in length. In addition to size the variety has the frontal distance between the antennæ not so conspicuously wider than the distance from antenna to eye. The variety has been collected only in the vicinity of San Francisco Bay and as far south as Bryson, California. It feeds on the native species of oak.

(To be Continued)

R
ADDITIONAL NOTES ON SOME CERAMBYCIDÆ
(COL.) FROM VANCOUVER ISLAND, B. C.

BY G. A. HARDY AND W. H. A. PREECE

The following paper constitutes the third of a series by the authors dealing with the Cerambycidæ of Vancouver Island: the previous two having also appeared in this quarterly (Vol. III, pp. 34 et seq, and pp. 187 et seq.).

NOTHORHINA ASPERA Lec.

This species feeds in the heartwood of Douglas Fir (*Pseudotsuga mucronata* Raf.) and would appear to require two years to complete its life cycle, as it has only been bred from two-year-old stumps, whereas none were reared from similar year-old stumps in the immediate vicinity. The borings, and more particularly the emergence holes, are perfectly round, so much so that an infested stump gives the appearance of having been used as a target for a small bore rifle.

For a short period after emergence from the ovæ, the larvæ feed in the sapwood; thereafter their life is spent in the heartwood wherein they bore long straight galleries up and down, parallel with the grain, usually well within the wood, some borings being more than 2 inches in from the sapwood.

The larva when fully matured constructs a pupal cell at the bottom of a long straight gallery which is parallel with the grain and usually about an inch in from the sapwood; the length of this gallery varies from 3 inches to 8 inches. At the top end the gallery turns at a right angle and an emergence hole is partially made through the intervening wood and into the bark. Plugs of shredded wood are inserted at the point of emergence and entrance to the pupal cell, the remainder of the gallery being clear of débris. The pupal period is from four to six weeks in duration.

The adult goes through quite a contortionist's performance when gnawing its way out, turning and twisting as it gnaws round and round the edge of the exit hole, testing about every five minutes to see if the hole is big enough. When at length all is clear it turns over onto its side and works one fore leg clear, with this it obtains a purchase and levers itself out.

In each case observed, the insect promptly crawled up to the top of the stump and took cover under a slab of bark placed there for its use and the convenience of the observer!

OPSIMUS QUADRILINEATUS Mann.

Evidence has been obtained of this species breeding in Bull Pine (*Pinus contorta* Dougl.). This is an addition to the host trees mentioned in our previous note (Pan-Pac. Ent., Vol. III, p. 34).

EUMICHTHUS ŒDIPUS Lec.

In our note on this species (Pan-Pac. Ent., Vol. III, p. 188), no mention was made of its host tree, as at the time it was written the information was not available. During 1927, however, a considerable number of specimens of the typical form as well as several of the variety *ruber* H. and P., were bred from caged boughs of Douglas Fir (*Pseudotsuga mucronata* Raf.).

Owing to the presence of the workings of other Cerambycids in the same wood, it is not possible to give a detailed life history but, from the observations it was possible to make, it would appear that the larvæ bore in the heartwood and that the species has a life cycle of one year's duration.

STENOCORUS VESTITUS Hald.

Up to the present no known evidence is extant as to food plant of this species. Larvæ observed in the underground roots of a dead Douglas Fir (*Pseudotsuga mucronata* Raf.) in January, 1927, were caged, and eventually proved to be the above, the adults emerging in June of the same year. The roots were partially decayed, so that no definite burrows were traceable.

STRANGALIA OBLITERATA (Hald.)

Further investigation necessitates amendment and addition to our previous note concerning this species (Pan-Pac. Ent., Vol. III, p. 189). It was stated that the larva makes no provision for the egress of the imago and certainly this held good in all cases examined in 1926; during 1927, however, provision for egress had been made in every case examined but one, the larva having bored to the inner surface of the bark, packing the outer portion of the burrow with shredded wood, the inner with frass. The pupal cell was an enlargement of the final perpendicular boring, whereas in the 1926 cases the larva had merely pupated at the top of the burrow without making any

attempt at forming a cell. The one exception referred to conformed to the 1926 principle in every detail and the imago found was dead and so dry that it fell to pieces when touched; it is considered altogether likely that it was a 1926 specimen which had failed to emerge through lack of a prepared exit, and that none of the 1926 specimens that were dug out would have won to daylight without the assistance of hammer and chisel. It is thought possible that the abnormally hot dry season of 1926 may have caused premature pupation, the larva being caught before it had time to complete its preparations. This species has now been bred from stumps of Douglas Fir (*Pseudotsuga mucronata* Raf.) in addition to stumps of Balsam Fir (*Abies grandis* Lindl.) as previously recorded.

XESTOLEPTURA CRASSIPES Lec.

A number of specimens have been obtained from caged Douglas Fir (*Pseudotsuga mucronata* Raf.) stumps. A brief account of a portion of its life history with Balsam Fir as the host was given in a previous note (Pan-Pac. Ent., Vol. III, p. 35).

DESMOCERUS CRIBRIPENNIS Horn

Abundant evidence of the work of this species in the living stem of Red-berried Elder (*Sambucus callicarpa* Greene) was obtained this summer (1927). From the examination of many bushes the life history could be fairly estimated.

The ovæ appear to be laid at or near the forks of the small upper branches, as many very young larvæ and their burrows are to be found at these situations. They work entirely in the pith of the stem, and as they increase in size work downward into the basal portion. A considerable length of burrow is clear of frass, in which the larva travels up and down quite freely. The loose texture of the pith and the fact of the indigestible matter being tightly compacted would account for the space without the necessity of ejecting it from the burrow.

The pupal cell is the terminal two or three inches of the burrow, the interior end is closed by a tight wad of coarse frass, or rather chewed fiber, finished off smoothly with finer particles. Previous to pupation the larva bores to within the inner surface of the papery bark, and then plugs the end to the extent of half an inch with fiber, it then retreats to the posterior end of the

cell where the final metamorphosis is effected, the pupa lying with head toward exit.

The pupal stage is probably of short duration, as larvæ in the act of changing were taken along with perfect pupæ in June, the imago emerging in July after gnawing an elliptical hole through the bark. Larvæ of considerable variation in size were taken at the same time, suggesting a two or three-year existence.

No especial gall-like growths were observed, but wart-like excrescences were apparent where the wood had healed old exit scars. The stems of many bushes were completely killed by the activities of this species; only the living stem is attacked by the larvæ.

The adults emerge in June and July and may usually be found on the leaves and flowers.

ULOCHÆTES LEONINUS Lec.

The pupa of an Asilid fly, *Dasyliis astur* O. S., was taken from a fresh burrow of *Ulochætes leoninus* Lec. The presumption that it preys on the Cerambycid larva is in agreement with the recorded habits of certain members of this Dipterous family.

NECYDALIS CAVIPENNIS Lec.

The larvæ of this species were taken in an old stump of Garry Oak (*Quercus garryana* Dougl.). From the presence of newly emerged adults and well-grown larvæ at the same time, it would seem that this stage extends for at least two years.

The larva works in the heartwood, its burrow and pupal cell being exactly similar to that of *N. lævicollis* (Pan-Pac. Ent., Vol. III, p. 37).

MOLORCHUS LONGICOLLIS Lec.

A fully matured specimen was dug out of a small branch of Douglas Fir (*Pseudotsuga mucronata* Raf.) on September 11, 1927. The bough was one of a quantity that had been caged indoors for a number of months and the heat of the house had perhaps hastened maturity.

This species bores in the heartwood and requires at least two years to complete its life cycle. Under normal circumstances we presume it pupates and emerges late in the fall, the imago hibernating in the pupal cell and leaving the wood in April.

Owing to the presence of borings of two if not three other Cerambycid species in the same wood it was not possible to

obtain a sufficiently clear idea of the workings of this species to enable us to describe them in detail.

CALLIDIUM VANCOUVERENSE V. D.

This recently described species (Pan-Pac Ent., Vol. III, p. 104), feeds beneath the bark of Douglas Fir (*Pseudotsuga mucronata* Raf.) and takes one year to complete its life cycle.

The adults are active during April and May and are most frequently to be found running over slash piles in the sunshine. The female when ovipositing crawls along the branches with ovipositer extended, trailing and traversing from side to side in search of crevices, etc., suitable for the purpose in hand. A suitable spot being found the ovipositer is inserted and the insect remains motionless for a few seconds, then moves on again, the ovipositer searching as before.

The larvæ spend the whole of their existence in the sapwood scoring it to the depth of 1/16 inch during the later stages. On reaching maturity the larva dips abruptly into the heartwood, turning at a right angle on reaching a depth of approximately one-half inch, and then bores a gallery parallel with the grain, varying from 1 inch to 2 inches in length; at the end a pupal cell is hollowed out, this cell being simply a slight enlargement of the gallery. The gallery is entirely cleared of refuse with the exception of a plug of shredded wood at the entrance to the pupal cell. The larva before pupating, gnaws almost through the bark at the point through which the imago will emerge.

Pupation sometimes takes place in late November and December, the adult emerging a few weeks later, spending the winter in the cell and leaving the wood at the beginning or middle of April. At other times the winter is spent in the larval stage, pupation taking place in March or early April. The latter procedure seems to be the one more usually followed.

The borings of this species in the heartwood are distinctly elliptical and bear a strong resemblance to Buprestid work, as does also the emergence hole.

PHYMATODES ÆNEUS Lec.

This species, which formed the subject of a brief previous note (Pan-Pac. Ent., Vol. III, p. 190), is a subcortical borer with a life cycle of one year's duration.

The imagines are active during May and June, and ovæ are deposited during that period on scars, wounds, etc. The slash from Douglas Fir (*Pseudotsuga mucronata* Raf.) appears to be the host most favored, from twigs less than three-quarter inch in diameter up to the largest branches, the smaller boughs having first preference. Small stumps and trunks of small dead trees are sometimes utilized.

The boring and pupating habits vary considerably, but in accordance with the locale. In the cases of stumps, trunks or branches of considerable thickness, the larvæ feed to some extent on the inner bark and make the pupal cell in the bark; in branches of medium size the pupal cell is constructed partially in the heartwood so that when the bark is removed the pupæ are found with the head and prothorax protruding from the heartwood; in small branches and twigs the larva bores right into the center of the heartwood and there forms its pupal cell; this sometimes has two borings connecting it with the inner bark, but frequently only one.

Pupation is of very brief duration, and no cases have been observed of the species overwintering in the pupal stage.

It is of interest to note that specimens emerging from stumps and trunks are noticeably larger and darker than those from small branches, due no doubt to a more plentiful supply of nutritious food.

XYLOTRECHUS UNDULATUS Say

In a note on this species (Pan-Pac Ent., Vol. III, p. 39), it was stated that Douglas Fir (*Pseudotsuga mucronata* Raf.) was believed to be the host tree most commonly utilized, though at the time proof was lacking. This statement has now been vindicated; several specimens having been reared from caged Douglas Fir stumps.

SAPERDA CALCARATA Say

The work of this species has been observed in the Aspen (*Populus tremuloides* Michx.). The trees in question are the remnant of a large grove, and were severely infected, the death of several being obviously due to this cause.

The larvæ were working only in the living trees, or the living portions of dying ones. Young larvæ were found between the bark and wood; these soon, however, bore into the heartwood

which was honeycombed with their burrows. Frass is ejected from the borings, often accumulating in conspicuous piles at the base of the tree; sap exuding from the hole is also very noticeable, causing a dark stain to appear on the bark. A marked characteristic of the burrows is the wide shallow flare at the lower portion extending in from the exit for $1\frac{1}{2}$ to 2 inches. Individual burrows measured from 4 to 6 inches in total length.

The pupal stage is passed at the inner end of the burrow, the pupal cell being formed by plugging the former, for an extent of one inch, with coarse shreds of wood fiber, finishing off the interior with finer particles. The pupa lies with head toward exit which is the opening previously used for the ejection of frass. Larvæ of various sizes were found at the same time, indicating a period of growth of about three years.

A NEW COSSID FROM NEW MEXICO (LEPID., COSSIDÆ)

BY WILLIAM BARNES AND F. H. BENJAMIN
Decatur, Illinois

***Comadia polingi* Barnes and Benjamin, sp. nov.**

Male. Fore wing with the ground color white, irrorated with black, the costa more or less marked by a black line, base of radius marked by a black dash, the medial vein strongly black marked, other veins more or less black marked; considerable black between veins 2 and 3 on the discocellular and distad of cell, fringes checkered black and white. Hind wings fuscous.

The two females which we consider herein as the normal females of this species are similar to the males, but with the fore wings more powdered with black.

The species is close to *Comadia intrusa* B. and Benj., but differs therefrom by a more contrastingly black maculation upon a paler ground.

Type locality: Bent, Otero County, New Mexico.

Number and sexes of types: Holotype ♂; allotype ♀; 43 ♂ 1 ♀ paratypes, all June, O. C. Poling collector.

Holotype, allotype, and paratypes in Barnes collection through the courtesy of Mr. Poling, the majority of the paratypes returned to the collector.

A NEW HELMIS (COLEOPTERA-HELMIDÆ) FROM THE NORTHWEST

BY J. O. MARTIN

During the work of incorporating the collection of the late Albert Koebele with that of the California Academy of Sciences, I came upon a series of over one hundred specimens of what seems to be a very distinct species of *Helmis*. With the permission of Mr. E. P. Van Duzee, Curator, I offer the following description.

Helmis koebele Martin, n. sp.

Broadly oval, widest behind the middle. Head piceous, finely granulate on the front, clypeus closely, coarsely punctate. Antennæ reaching to about the middle of the thorax; basal joints ochraceous, the three apical joints piceous, and forming a distinct club.

Thorax piceous, shining, one-third wider at base than apex; slightly less than one-third wider than long; sides rounding at middle, sinuate before the frontal and basal angles; disc and apex finely, widely punctured, each puncture with a fine recumbent hair; on each side of the disc is a longitudinal fovea, deepest at the base and gradually narrowing to the middle, where it fades out, fovæ with a sharp external defining ridge.

Elytra ochraceous with a broad, transverse piceous band slightly behind the middle, which has a tendency to extend along the suture in both directions; but more strongly to the apex. Punctures of the striæ strongly impressed, the intervals rounded and broad, with scattered, minute punctures bearing decumbent, ochraceous hairs.

Underside of body piceous, variously stained with ochraceous. Legs piceous except tarsi, which are ochraceous. Length two, to two and a half millimeters.

Type, No. 2467, Mus. Calif. Acad. Sci., collected by Mr. Albert Koebele at **Easton, Washington**. Paratypes in the collection of the Academy and in that of the United States National Museum and of Mr. H. C. Fall.

A RARE ARADID

In a box of Hemiptera taken by Mr. O. C. Poling at Colton, California, and kindly presented to the California Academy of Sciences by Dr. E. C. Van Dyke, were two females of the rare *Aradus coarctatus* Heid. With these was a long series of *Aradus depictus* Van D. which would seem to be as abundant in southern California as about the Bay region. It probably can be found almost anywhere where the live oak grows.—E. P. Van Duzee.

BEEES BELONGING TO THE FAMILY BREMIDÆ¹
TAKEN IN WESTERN OREGON, WITH NOTESBY H. A. SCULLEN
Oregon Agricultural College
Corvallis, Oregon

The object of the following paper is to place on record the results of the writer's collecting for several years past, together with a study of material collected by others and now deposited in the collection of the Oregon State Agricultural College. An effort has also been made to include references to all published records of bumblebees taken in western Oregon, and to original descriptions of species known to occur there. About one thousand specimens of *Bremidæ* were available for study. These were collected in forty-eight different localities ranging from sea level to about 7000 feet.

Twenty-one species and seven varieties of *Bremus*¹ and four species and one variety of *Psithyrus* are recorded in the present paper. Two species of *Bremus* (*B. occidentalis* and *B. vosnesenskii*) may be considered abundant. Four (*B. appositus*, *B. californicus*, *B. melanopygus*, *B. mixtus*) are common, and the remainder are relatively uncommon to very rare. All five species of *Psithyrus* are uncommon to rare.

Bremidæ, representing one or more species, are to be found in abundance in all parts of western Oregon from sea level to the snow line in the Cascades. Several individual species, however, appear to be limited in their distribution by certain conditions associated with altitude. *B. californicus* and *B. vosnesenskii*, which are common at the lower altitudes, are seldom taken above 4000 feet elevation. *B. occidentalis*, on the other hand, is common at the low altitudes and also very abundant in the alpine meadows from 4000 feet to 6000 feet. *B. bifarius* var. *nearticus*, which is not uncommon above 4000 feet, is not recorded below that elevation, with the one exception given below. Too few specimens of many of the forms have been taken to determine their altitudinal range.

¹ Many leading hymenopterists (Rohwer, Lutz, Cockerell, et al.) continue to use *Bombidæ* and *Bombus*, while others (Frison, Viereck and some European workers) who have accepted the "Erlangen List" are now using *Bremidæ* and *Bremus*. Frison, 1919, p. 157, seems to justify the use of the latter names.

The writer is deeply indebted to Dr. Theodore H. Frison of the Illinois State Natural History Survey for his assistance in determining much of the material studied and for many constructive suggestions concerning this paper.

Many locality records of little importance for the more common species are omitted.

1. BREMUS NEVADENSIS (Cresson)

Cresson, 1874, p. 102, ♀, ♂, Nevada (Yarrow), Arizona (Henshaw). (Redescribed: Franklin, 1912, p. 416.)

Range: Alaska to New Mexico and east to Nebraska.

Only two specimens of this species have been taken in western Oregon.

Corvallis, ♀, VII-20, 1914 (F. I. Moe. Forest Grove, ♀, VII-29, 1916, L. P. R.).²

2. BREMUS SEPARATUS (Cresson)

Cresson, 1863a, p. 165, ♀, ♂, Pennsylvania, Rock Island, Illinois (Walsh), Canada (Saunders), redescribed: Franklin, 1912, p. 425, 428, Echo and Corvallis, Oregon.

Range: Alaska to Mexico and the Gulf of Mexico and from the Pacific to the Atlantic Coast.

This species is not uncommon in the Willamette Valley, but has not been taken elsewhere in western Oregon.

Albany, ♂, VIII-1, 1905 (Parsons). Corvallis, ♀, V-2, 1897, to IX-22, 1906 (Currin); ♂, VII-20, 1905 (Harlan), to IX-26, 1906 (Farrell); ♀, VI-12, 1924 (H. A. S.), to IX-11, 1921 (H. A. S.). Forest Grove, ♀, IX-17, 1915 (L. P. R.), ♂, and ♀, IX-17, to X-7, 1915 (L. P. R.). Hillsboro, ♀, ♂ and ♀, IX-30, 1915 (M. M. R.). Medford, ♂, VII-17, 1906 (Bennett). Monroe, ♀, VIII-6, 1904. Portland, ♀, VIII-5, to VIII-27, 1907. Salem, ♂, IX-24, 1921 (H. A. S.); ♀, IX-28, 1925 (H. A. S.).

3. BREMUS MORRISONI (Cresson)

Cresson, 1878, p. 183, ♀, ♂, ♂, Colorado (Morrison); Frison, 1926, p. 130. (Redescribed: Franklin, 1912, p. 431.)

Range: Western United States, east to South Dakota.

B. morrisoni is evidently very rare in western Oregon, since it has been taken only at two localities. It is probably confined to the lower altitudes.

Albany, ♀, VIII-2, 1905 (Parsons). Corvallis, ♀, VI-2, 1924, to VI-11, 1908 (Markel); ♀, V-1, 1914.

² To conserve space, initials only are used for collectors whose names occur frequently: A. H. A.=A. H. Amos; A. L. L.=A. L. Lovett; D. A. W.=D. A. Wilbur; G. R. McG.=G. R. McGinnis; H. A. S.=H. A. Scullen; W. J. C.=W. J. Chamberlin; M. M. R.=M. M. Rheer; L. P. R.=L. P. Rockwood.

4. *BREMUS KIRBYELLUS* (Curtis)

Curtis, 1835, p. lvii (*kirbiellus*). ♀, ♂, ♂. Arctic America. (Redescribed: Franklin, 1912, p. 290.)

Franklin, 1912, p. 294, Mount Hood, Oregon. (Doubtless refers to Viereck's record, 1904, p. 99.)

Range: Arctic America to the higher altitudes of Colorado and New Mexico. Viereck's record (1904, p. 99), from Mount Hood is the only record for Oregon. The species is evidently very rare in Oregon and doubtless confined to the very high altitudes. There is one unlabeled specimen in the collection at the Oregon State Agricultural College.

5. *BREMUS OCCIDENTALIS* (Green)

Green, 1858, p. 12, Northwest Coast of America, Fort Vancouver (Cooper) and Puget Sound (Suckley). (Redescribed: Franklin, 1912, p. 265.)

Cresson, 1879, p. 231, Oregon; Viereck *et al.*, 1904, p. 99, Corvallis and Mount Hood; Franklin, 1912, p. 272; Frison, 1927, p. 367, Olney, Mount Hood, Corvallis, Newport, Coolestin, Alsea Grade (Benton County), Oregon.

Range: Alaska to New Mexico and east to South Dakota.

B. occidentalis is one of the most abundant species of bumblebees in western Oregon. In the lower valleys it seems to be more common in the wooded districts. In the mountain meadows in the Three Sisters region the writer found it to be the most abundant species August 6 to 16, 1926. It was working mostly on *Aster* at all high elevations up to 6000 feet.

Alsea, ♂, and ♀, VIII-18, 1917 (A. H. A.). Corvallis, ♀, III-21, 1926, (H. A. S.), to IX-4, 1921 (H. A. S.); ♂, VI-29, 1925 (D. A. W.), to VIII-10, 1922 (H. A. S.); ♀, VII-19, 1925 (D. A. W.), to VIII-22, 1922 (H. A. S.), Coos Bay, ♂, VI-20 and VII-19, 1926 (H. A. S.); ♀, VI-20, and VII-10, 1926 (H. A. S.). Eugene, ♂, VIII-16, 1905 (Foster). Fish Lake (Santiam Forest, elevation 3150 feet), ♂ and ♀, IX-5, 1925 (D. A. W.); Gold Beach, ♀, VII-11 and VII-12, 1925 (H. A. S.); Grants Pass, ♀, VII-4, 1906; Hillsboro, ♀, ♂, ♀, IX-30, 1915 (M. M. R.). Mary's Peak (Benton County, elevation 4000 feet), ♂, VIII-2, 1926 (H. A. S.). McKenzie Bridge (elevation 1329 feet), ♀ VIII-25 and VIII-27, 1924 (H. A. S.). Oswego, ♀, VII-10, 1907 (Georgia Ewing). Rainier, ♀, VII-17, 1907. Salem, ♂ and ♀, IX-24, 1921 (H. A. S.). Three Sisters region: Scott Lake (elevation 4650 feet), ♀, ♂ and ♀, VIII-7, 1926; and White Branch Creek (elevation 6000 feet), ♀, VIII-11, 1926 (H. A. S.). Toledo, ♀, VI-5, 1925 (H. A. S.). Wahtum Lake (elevation 3700 feet), ♀, VIII-24, 1923 (H. A. S.).

6. *BREMUS OCCIDENTALIS* var. *PROXIMUS* (Cresson)

Cresson, 1863, p. 98, ♀, Utah (Suckley). (Redescribed. Franklin, 1912, p. 270.)

Range: Western United States.

This variety is rare in Oregon. It has been taken only in the lower altitudes.

Coos Bay, ♂, VII-19, 1926 (H. A. S.). Corvallis, ♀, VIII-31, 1925 (H. A. S.), ♂, VII-23, 1925 (H. A. S.) Gold Beach, ♀, VII-10, 1925 (G. R. McG.). Salem, ♂, IX-24, 1921 (H. A. S.). Three Sisters region: Deer Butte (elevation 4650 feet), ♂, VIII-9, 1926 (H. A. S.).

7. *BREMUS FRANKLINI* Frison

Frison, 1921, p. 147, ♀, Nogales, Arizona (E. J. Oslar). *Morphotype* ♀ and *allotype* ♂, Frison, 1922, pp. 314-315, Oregon (C. F. Baker); Frison, 1926, p. 132.

Range: Western United States.

The only other records of *B. franklini* for Oregon, in addition to the types, are two workers taken by the author. The species seems to be rare throughout its range.

Gold Hill, ♀, VII-2, 1925 (H. A. S.). Roseburg, ♀, VI-29, 1925 (H. A. S.).

8. *BREMUS HUNTII* (Greene)

Greene, 1860, p. 172, ♀, "Utah Territory." (Redescribed: Franklin, 1912, p. 319.)

B. ternarius Viereck *et al.*, 1904, p. 99, Condon and Corvallis, Oregon, ♀, VII-14, 1900 and VIII-14, 1900 (Tulley). See Lutz and Cockerell, 1920, p. 519; Franklin, 1912, p. 322, Oregon.

Range: From Canada to New Mexico and east to Nebraska and the Dakotas.

B. huntii is a Rocky Mountain form rarely found in western Oregon. All specimens from western Oregon are from the Willamette Valley.

Corvallis, ♀, VI-8, 1900 (Bennett); ♂, IX-29, 1924 (H. A. S.). Salem, ♀, IX-24, 1921 (H. A. S.).

9. *BREMUS EDWARDSII* (Cresson)

Cresson, 1878, p. 184, ♀, ♀ (not ♂) California; Vancouver Island, B. C. (Edwards); Colorado (Morrison). "Possibly one of the last two is erroneous" (Lutz and Cockerell, 1920, p. 512). (Redescribed under name of *fernaldi*: Franklin, 1911, p. 157, and 1912, p. 323. See Frison, 1922, p. 317; 1926, p. 133.)

Range: Alaska to California and east to Colorado.

From the present records it would appear that this species may be limited in Oregon to the Willamette Valley and the coastal region.

Brookings, ♂, VII-9, 1925 (G. R. McG.). Corvallis, ♂, 1900. Gold Beach, ♀, VII-10, 1925 (G. R. McG.).

10. BREMUS EDWARDSII var. RUSSULUS Frison

Frison, 1927, p. 374, ♀, Yosemite Valley, California.

Range: Higher altitudes of California and Oregon.

Three Sisters region; Finger Board Prairie (elevation, 3825 feet); ♀, VIII-14, 1926 (H. A. S.).

11. BREMUS VOSNESENSKII (Radoszkowski)

Radoszkowski, 1862, p. 589, n. 13, ♀, ♂, T. 6, F. 1. California (Vosnesensky). (Redescribed: Franklin, 1912, p. 325.)

Frison, 1927, p. 368. Mount Hood, Olney, Waldport, Jacksonville, Ashland, Crater Lake, Oregon.

Range: From British Columbia to southern California and east to Nevada. Franklin says: "It belongs mainly to the Pacific Coast portion of the Transitional Zone, not crossing the Sierra Nevada Range to any great extent."

B. vosnesenskii is by far the most common species of bumblebee in the lower altitudes of western Oregon. It has been taken as high as 4650 feet in the region of the Three Sisters by the author, but is very uncommon at such high altitudes.

Brookings, ♂, VII-9, 1925 (G. R. McG.); ♀, VII-8 and VII-9, 1925 (H. A. S.). Cascadia, ♀, VIII-11, 1924 (H. A. S.). Corvallis, ♀, II-28, 1926 (H. A. S.), to VII-26, 1907 (V. E.); ♂, VII-17, 1925 (D. A. W.), to IX-22, 1906 (Currin); ♀, VII-1, 1923 (H. A. S.), to IX-11, 1921 (H. A. S.). Fish Lake (Santiam Forest, elevation 3150 feet), ♀, 1905 (Cate). Gold Beach, ♀, VII-12, 1925 (H. A. S.); ♂, VII-10, 1925 (H. A. S.); ♀, VII-10, 1925 (G. R. McG.). Grants Pass, ♀, IV-25, 1917 (C. W. Creel), to VII-1, 1925 (H. A. S.). Manzanita, ♀ and ♂, VII-30, 1920 (L. P. R.). Mary's Peak (elevation, 4000 feet), ♀, V-30, 1924 (H. A. S.). McKenzie Bridge, (elevation, 1329 feet), ♀, VIII-25, 1924 (H. A. S.). Mount Jefferson, ♀, September (A. L. L.). Newport, ♀, VII-13, 1905 (Davis). Oregon Mountain (Josephine County), ♀, VII-5, 1925 (H. A. S.). Portland, ♀, VI-18, 1925 (H. A. S.). Rainier, ♂, VII-17, 1907, and VIII-25, 1907 (E. Newkirk); ♀, VIII-25, 1907 (E. N.). Roseburg, VI-27, 1925 (G. R. McG.); ♀, VI-28, 1925 (H. A. S.). Sexton Mountain Josephine County, elevation 2046 feet), ♀, VI-30, 1925 (H. A. S.). Three Sisters region (Cascade Mountains); Scott Lake (elevation, 4650 feet), ♂, VIII-7, 1926 (H. A. S.); ♀, VIII-9, 1926 (H. A. S.); Deer Butte, ♂, VIII-9, 1926 (H. A. S.); Fingerboard Prairie, ♂, VIII-14, 1926 (H. A. S.). Wahtum Lake (Mount Hood region, elevation 3700 feet), ♂, and ♀, VIII-24, 1923 (H. A. S.).

12. *BREMUS BIFARIUS* var. *NEARTICUS* (Handlirsch)

Handlirsch, 1888, p. 243, ♀, ♂, ♂, British Columbia. (Redescribed: Franklin, 1912, p. 333. *B. bifarius* is described by Franklin, 1912, p. 328, under the name *Bombus edwardsii*. See Frison, 1922, p. 317.)

Frison, 1926, p. 134; 1927, p. 369, Crater Lake, Mount Hood, Oregon.

Range: Probably from Alaska to California and east to the Rocky Mountains.

With the exception of the one Forest Grove record this species has not been taken below 3000 feet elevation. It is apparently confined mostly to the higher altitudes (4000 to 6000 feet) of the Cascade Mountains, where it is common on *Aster* in the alpine meadows.

Belknap Springs (elevation 1650 feet), ♂, VIII-10, 1925 (G. R. McG.). Fish Lake (Santiam Forest, elevation 3150 feet), ♂, VII-5, 1925 (D. A. W.). Forest Grove, ♀, IV-17, 1926 (H. A. S.). Three Sisters region; Frog Camp (elevation 4700 feet), ♀ and ♂, VIII-15, 1926 (H. A. S.); McKenzie Pass (elevation 4650 feet), ♀ and ♂, VIII-12, 1925 (G. R. McG.); Scott Lake (elevation 4650 feet), ♂, VIII-7 and VIII-12, 1926 (H. A. S.); ♂, VIII-7 to VIII-13, 1926 (H. A. S.).

13. *BREMUS SYLVICOLA* (Kirby)

Kirby, 1837, p. 272, latitude 65 degrees, America.

Range: Alaska and western Canada.

This is a species of the far north which is here recorded for the first time for Oregon. It is apparently confined mostly to the high altitudes. One ♂, however, was taken at Coos Bay on *Digitalis purpurea*. In the Three Sisters region it was taken on *Aster* and *Epilobium angustifolium*.

Coos Bay, ♂, VI-20, 1926 (H. A. S.). Three Sisters region; Skieline Trail (elevation 5400 feet), ♂, VIII-11, 1926 (H. A. S.); west side timber line (elevation 6500 feet), ♂, VIII-11, 1926 (H. A. S.) White Branch Creek, ♂, VIII-11, 1926 (H. A. S.).

14. *BREMUS MELANOPYGUS* (Nylander)

Nylander, 1848, p. 236 (*melanophyge*). ♂. Sitka. (Redescribed: Franklin, 1912, p. 334.)

Viereck *et al.*, 1904, p. 99, Corvallis (Cordley) and Mount Hood, Oregon. Frison, 1927, p. 370, Olney, Newport, Mount Hood, Alsea Grade (Benton County), Marshfield, Waldport, Oregon.

Range: Alaska south to Oregon and Colorado; east to central Canada and the Rocky Mountains.

This species is not uncommon in many parts of western Oregon. It has been taken from near sea-level up to 2046 feet

(Sexton Mountain). It does not appear to be in the higher altitudes as one might expect from Franklin's report (1912, p. 337).

Clatskanie, ♂, V-16, 1925 (H. A. S.). Coos Bay, ♂, VI-20, 1926 (H. A. S.). Corvallis, ♀, III-15, 1926, to IV-24, 1922 (both H. A. S.); ♀, V-9, 1926, to VI-16, 1925 (both H. A. S.). Forest Grove, ♀, III-30, 1918 (M. M. R.). Gold Beach, ♀ and ♂, VII-10, 1925 (G. R. McG.). Grants Pass, ♀, VII-4, 1925 (G. R. McG.); McKenzie Pass (elevation 4650 feet), ♂, VIII-12, 1925 (G. R. McG.). Monroe, ♂, 1925. Mount Jefferson, ♂, VIII-17 (A. L. L.). Newport, ♂, V-16, 1915. Sexton Mountain (Josephine County, elevation 2046 feet), ♂, VI-30, 1925 (H. A. S.). Waldport, ♀, II, 1926 (J. E. Davis); ♂, IV-25, 1926 (B. G. T.). Wilson, ♂, VIII-5, 1916 (M. M. R.).

15. *BREMUS SITKENSIS* (Nylander)

Nylander, 1848, p. 235. ♀, ♂, ♂. Sitka, Alaska. (Redescribed: Franklin, 1912, p. 377.)

B. oregonensis (Cresson), 1878, p. 185, ♂, Oregon (Edwards); *B. oregonensis* (Viereck *et al.*), 1904, p. 99, Corvallis, Oregon (Cordley); Franklin, 1912, p. 381, Mount Hood, Oregon; Frison, 1927, p. 372, Waldport, Olney.

Range: Alaska to California and east to the Rocky Mountains.

B. sitkensis is quite generally distributed over western Oregon, although uncommon. It ranges from sea-level to over 5000 feet elevation in the Three Sisters region. It is not uncommon in the coast mountains.

Albany, ♂, VIII-10, 1917 (A. H. A.). Alsea, ♀, V-29, 1926 (H. A. S.). Alsea Mountain, ♀, III-9, 1926 (H. A. S.). Brookings, ♂ and ♂, VII-8, 1925 (H. A. S.). Cascadia, ♂, VIII-15, 1924 (H. A. S.). Coos Bay, ♂, VI-20 and VII-17, 1926 (both H. A. S.); ♂, VI-18 and VI-17, 1926 (both H. A. S.). Corvallis, ♀, III-24, 1926 (H. A. S.); ♂, VIII-8, 1925; ♂, V-18, 1915, to IX, 1926 (H. A. S.). Kings Valley, ♂, VII, 1907. Mary's Peak, ♂, VII-8, 1914 (L. G. Gentry). Rockaway, ♂, VI-27, 1920 (L. P. R.). Three Sisters region; Skieline trail (elevation 5400 feet). ♂, VIII-11, 1926 (H. A. S.); Fingerboard Prairie, ♂, VIII-14, 1926 (H. A. S.). Toledo, ♀, VI-5, 1925 (H. A. S.). Triangle Lake (Lane County), ♀, V-24, 1925 (H. A. S.). Waldport, ♂, VI-5, and VI-7, 1925 (H. A. S.). Wilson (Tillamook County), ♂, and ♂, VIII-7, 1916 (M. M. R.). Woodruff Meadows (Jackson County, elevation 3200 feet), ♂, VII-4, 1922 (W. J. C.).

16. *BREMUS CALIGINOSUS* Frison

Frison, 1927, p. 376, ♂, Arcata, California (C. D. Duncan, September 16, 1920).

Frison, 1927, p. 379, Corvallis, Kings Valley, Alsea, Gold Beach, Oregon.

Range: Western parts of Oregon, Washington, and California.

Alsea, ♂, VII-29, 1922, and VIII-2, 1921 (both H. A. S.). Brookings, ♂, VII-9, 1925 (H. A. S.). Coos Bay, ♂, VI-20, 1926 (H. A. S.). Corvallis, ♂, IX-1, 1924 (H. A. S.). Gold Beach, ♂, VII-10, 1925 (H. A. S.). Kings Valley (Benton County), ♂, VII-18, 1905 (Vincent).

17. BREMUS MIXTUS (Cresson)

Cresson, 1878, p. 186, ♀, ♂, Colorado (Morrison). (Redescribed: Franklin, 1912, p. 381.)

Franklin, 1912, p. 384, Oregon; Frison, 1927, p. 371, Newport, Olney, Corvallis, Waldport, Alsea Grade (Benton County), Coolestin, Oregon.

Range: Alaska and central Canada south to northern California and east to Montana and Colorado.

B. mixtus is one of the more common species of the lower elevations of western Oregon. It is especially common in the lower altitudes of the Coast Mountains. This species seems to nest earlier than most others, as the first worker bumblebees to appear are usually of this species.

Alsea Mountain, ♀, III-9, 1926 (H. A. S.); ♂, VIII-2, 1925 (H. A. S.); ♀, V-5, 1923, to VII-20, 1921 (both H. A. S.). Brookings, ♀, VII-8, 1925 (H. A. S.). Corvallis, ♀, III-19, 1926 (H. A. S.), to V-15, 1898; ♂, V-28, 1915 (E. Dunn), to VIII-3, 1897; ♀, IV-14, 1926 (H. A. S.), to IX-9, 1906 (Schrack). Elam, ♀, IV-18, 1926 (H. A. S.). Eugene, ♂, VIII-21, 1921 (H. A. S.). Fish Lake, (Santiam Forest, elevation 3150 feet), ♀, IX-5, 1925 (D. A. W.). Forest Grove, ♀, III-31, 1914 (L. P. R.), to V-13, 1917 (Lane); ♂, VII-20 to IX, 1918 (both Lane); ♀, V-20, 1918 (Cole). McKenzie Pass (elevation 4650 feet), ♂, VIII-12, 1925 (G. R. McG.). Medford, ♀, VII-17, 1906. Oregon Mountain (Josephine County), ♂, VII-5, 1925 (H. A. S.). Portland, ♀, VI-18, 1925 (H. A. S.). Rainier, ♂, VII-17, 1907. Salem, ♀, IV-12, 1924 (D. A. W.). Three Sisters region; Scott Lake (elevation 4650 feet), ♂, VIII-9, 1926 (H. A. S.); Timber line, west side (elevation 6500 feet), ♂, VIII-11, 1926 (H. A. S.). Toledo, ♂, VI-5, 1925 (H. A. S.). Triangle Lake (Lane County), ♂ and ♀, V-24, 1925 (H. A. S.). Wahtum Lake Mount Hood region, elevation 3700 feet), ♂, VIII-24, 1923 (H. A. S.). Woodburn, ♀, VII-6, 1906 (Kinnison).

(To be Continued)

THE CELERY LEAF-TYER, *PHLYCTÆNIA RUBIGALIS* GUEN., IN CALIFORNIA (LEP.)

BY ROY E. CAMPBELL

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The celery leaf-tyer, or celery worm, known also as the greenhouse leaf-tyer (2, 5, 10)¹ is a common greenhouse pest in the United States. It also attacks several outdoor crops, notably celery and sugar beets, and in California has caused serious loss to the celery industry. During its attacks on sugar beets considerable foliage is destroyed, but the actual damage is usually negligible, because the beets are usually well grown before being attacked and because ordinary feeding on the heavy foliage of the beet does not noticeably affect crop yields.

HISTORY AS AN OUTDOOR PEST

The first mention of this insect as an outdoor pest was in 1893, when G. C. Davis (4) reported it from Michigan as boring into the crown and feeding on the leaves of celery. Chittenden (2) reported numerous larvæ in a celery field in the District of Columbia in 1897, and observed the moths in a rhubarb field in 1898 and 1899. Forbes and Hart (6) reported a few adults and larvæ from a beet field in Illinois in 1900. The United States Department of Agriculture Yearbook for 1907 (9) mentions this insect as injurious to sugar beets in California, and Bethune (1) in 1909 reported it as sometimes occurring on celery in Ontario.

The first record of occurrence outdoors in California is in 1907 (9), but the first account of damage to celery was made by Quayle (7) in 1910 who writes that "it has been known to exist in Orange County for several years, but did not do serious damage until last year." Rogers (8) in 1911 writes as follows:

"During the past season the celery fields have suffered severely from attacks of the celery leaf-tyer (*Phlyctania ferrugalis* Hbn.). This insect has been seen in small numbers previous to this year, but had caused no large losses. This season, however, many acres of celery were almost totally destroyed by it. The worms commenced their devastations early in September and became worse up to the time the cold weather and rains set in, and from then to the last of the season they were present in most of the fields, although they were not very active."

¹ Numbers in parentheses refer to "literature cited," p. 83.

Inquiries among growers and buyers of celery in the affected districts confirmed the foregoing, all agreeing that the damage became serious in 1909 and 1910, but that larvæ, moths, and scattering infestations had been observed for several seasons previously. In 1921 celery grown near the coast in Los Angeles County was severely damaged. It has in recent years become a serious celery-crop hazard in the vicinity of Sanford, Florida.

CHARACTER OF INJURY

The newly hatched larva spins a thin web, usually on the lower surface of the leaf, under which it feeds. At first only the epidermis of the leaf is eaten, but as the larva increases in size, holes are eaten through the leaves, and as feeding continues, these holes enlarge. More mature larvæ web parts of a leaf together or two contiguous leaves, in which sheltered place feeding continues. When only a few larvæ are present, slight damage is done, but if they are numerous the leaves may be skeletonized, and in severe attacks the plants are defoliated. Hence, the main injury to the celery crop in California from the leaf-tyer is the actual destruction of the foliage.

The larvæ also often make their way down into the heart of the plant, and feed on the sides of the stems, eating out irregular cavities which turn dark and are very unsightly. A large quantity of frass is left by the larvæ, which may become entangled in the web and leaves, greatly increasing the unsightliness of the celery.

Badly injured celery is unmarketable. Celery bunches with larvæ, webs, and frass in the foliage, or with the foliage a little eaten, or with the blotches on the stems, are greatly reduced in market value.

EXTENT OF DAMAGE

In the Orange County district, up to about fifteen years ago, from 5000 to 7000 acres of celery, valued at that time at over a million dollars, were raised annually. Owing to losses from the leaf-tyer and a disease, late blight,² this acreage began to decrease about 1911, and a sharp decline followed, until in 1916 there were less than 200 acres in the entire district. It has been estimated that one-fourth of the responsibility for this abandonment attaches itself to the celery leaf-tyer. During

² *Septoria petroselinii* var. *apil*.

the period of greatest damage, just prior to and during the years of the rapid decline in acreage, 25 per cent of the bunches had to be discarded in many fields. Of those shipped, there was a considerable reduction in the market value on account of minor damage to the celery, or the presence of a few worms.

In the last few years a considerable acreage along the coast of Los Angeles County has been devoted to the raising of celery, maturing during the late summer and fall. This has been subject to severe damage by the leaf-tyer.

DESCRIPTION ³

The adult is a small moth, clay brown in color, with a wing expanse of about three-fourths of an inch. The fore wings are clay brown, irregularly marked with black lines. The hind wings are gray, becoming brownish toward the ends. Both pairs of wings have a border of small black dots.

The typical position of the moth at rest is with the inner margins of the fore wings parallel and touching down the dorsum. The palpi extend rather prominently in front of the head.

The egg is broadly ovate, flattened, grayish white, but sufficiently translucent to reveal through it the color of the surface upon which it is deposited; the upper surface is shiny and iridescent. The flat, oval shape, the iridescence, and the overlapping manner in which the eggs are laid give the mass a resemblance to fish scales. As it develops, the egg turns darker, and the dark head of the embryonic larva can easily be made out through the shell. The length averages about 0.8 millimeter and the width 0.6 millimeter.

The larva when newly hatched is pale yellowish white, with a darkish head. It is about 2 millimeters long and less than half as wide. As the larva feeds, it takes on a greenish appearance. The full-grown larva is pale green or greenish yellow, and slightly translucent. Along the back there is a somewhat conspicuous green median stripe, on each side of which are double lines of white. The head is light, with faint dark spots. The surface is sparsely covered with rather long hairs. The full-grown larva is a little over three-fourths of an inch long and one-twelfth of an inch wide.

The pupa is dark, shiny brown, with conspicuous spines on the dorsum. Wing-pads and legs show plainly on the ventral side. It is slightly less than three-fourths of an inch long.

DISTRIBUTION

As an outdoor pest the celery leaf-tyer has been reported from Ontario, Canada, to Florida, and from Michigan to California and subtropical Texas. It may be found in all celery sections of southern California and is present in largest num-

³ For complete description and synonymy, see (10).

bers and has done the greatest damage near the coast in Orange and Los Angeles counties. In the El Monte section of Los Angeles County adults may be found throughout the season, but there only occasional damage is done. It occurs in Ventura County and a few specimens have been taken at Davis, in the Sacramento Valley. Other records of occurrence as an outdoor pest are Sanford, Fla.; Baton Rouge, La.; Moreton, Delaware County Pa.; Alameda, Brownsville, Childress, and San Benito, Texas; Diamond Springs, Norfolk, and Shelton, Texas.

LIFE HISTORY IN CALIFORNIA

The moths lay their eggs on the lower surface of the leaves, or on the stems, either singly or in masses. Usually from three to eight are laid in an imbricated group, but the number may run as high as a dozen. The length of the oviposition period ranges from eight to nineteen days, averaging thirteen, and the number of eggs laid by a single female is from 48 to 176, with an average of 130.

The duration of the different stages in the life history of the celery leaf-tyer varies considerably according to the temperature, being much shorter in summer than in winter. The egg stage ranges from a minimum of four days in the summer, when the mean temperature is around 70 degrees F. to a maximum of thirty days in the winter, when the mean temperature is about 50 degrees F.; the larval stage from twenty-one to sixty-eight days. After the larva reaches maturity it ties itself up in a leaf or leaves and remains quiet for several days before turning to the pupa. This prepupal stage may last from two to ten days, and the pupal stage from six to thirty-seven days. Table 1 gives the maximum, minimum, and average number of days for each stage for the four seasons of the year, and Table 2 shows the monthly maximum, minimum, and mean temperatures for the same period. In captivity the length of the adult life was from six to thirty-four days, with an average of nineteen days.

HABITS

Soon after hatching, the young larva begins feeding on the under side of the leaves. At first only the lower epidermis is eaten, but as the larva grows it becomes more voracious and eats the entire foliage. Its leaf-tying habit soon begins to

manifest itself by the silken web with which it fastens together parts of a leaf, or two or more leaves if they happen to be in close proximity. The larva continues to feed and grow in this manner, remaining concealed in a cluster of foliage, or tied up in a single leaf. When disturbed, a larva will wriggle violently and drop down among the lower foliage or to the ground. When fully mature, the larva ties itself up tightly in a leaf or leaves, as described above, and in this protected place transforms to the pupa.

The moths begin flying about sundown, and continue to fly through the early evening. During the day they remain in hiding on the under side of a leaf or amid the foliage, and only fly when disturbed. Then they fly in a rapid, jerky manner, over the tops of the plants, and usually for a short distance only, alighting on a near-by plant, and immediately hiding under the leaves.

NUMBER OF GENERATIONS PER YEAR

From Table 1 it may be seen that during the winter the insect requires over three months to complete a generation, from oviposition to emergence of the adult; in the spring, about two months; in the summer, a little over one month; and in the fall, somewhat less than two months.

A careful check of the life-history studies carried through three seasons indicates that ordinarily there may be a maximum of five or six generations a year. Three or four of these occur during the six months from June to December, which is the active growing season for celery, and the remaining two generations occupy the balance of the year.

The generations are not entirely distinct, as there is considerable overlapping, and, while they can be observed with no great difficulty in the laboratory, they are usually too indistinct for recognition in the field.

In Table 3 is shown a continuous-generation series carried through more than a year. The first eggs from the first adults to emerge in the second and fifth generations failed to hatch, making it necessary to replace them with fertile eggs produced later. This slightly broke the continuity of the series. From eggs laid July 4, adults of the fifth generation were produced on June 18 to 23. Adding the two weeks until the end of the

year and the more than three weeks which elapsed between the second and third generations, gives ample time for the sixth generation to be produced within the year.

SEASONAL HISTORY

The main celery crop of California is practically all harvested before March 1, only a comparatively small acreage remaining later than that date. At that time the larvæ and adults are scarce, and the development of those that are present is slow.

The larvæ live on celery along drainage ditches, in the late or old abandoned fields, in old seed beds, on beets, or anywhere where their food plants are available. With warmer weather their growth and activity increase, and they will be found infesting sugar beets as well as, to a lesser degree, the celery seed beds. If a celery field is near a beet field, an infestation of the former may be expected soon after the beets are harvested, for the moths, when deprived of the shelter of the dense foliage of a mature beet field, will migrate to the celery field.

Ordinarily an infestation of any consequence occurs in the celery field about the first of September, although in some seasons it may take place as early as the middle of August. The larvæ and adults increase rapidly in numbers during September, and are very plentiful in October. By November the cooler weather, especially if there have been early rains, slows up the growth of the larvæ, and the number of both larvæ and adults becomes less. However, if warm weather continues into November, the worms will continue their activity. By December and January they will have become scarce, and only a very few can be found in February or March.

The main crop of celery is usually transplanted in July and early August and, owing to severe cutting of both top and roots, does not make much growth during the first month in the field. Hence the celery is small when infestation by the leaf-tyer begins, and the growth is very materially checked if the infestation is at all serious. Fields of excellent celery have been observed which were badly infested, and although the larvæ were finally killed by spraying, sufficient damage was done to set back harvesting more than a month.

Early planted celery usually receives the most damage, because it is exposed to infestation while the plants are small, and is ready to harvest before the larvæ have become scarce.

The later planted and marketed celery may be injured somewhat at first, but has more of a chance to recover and make a good growth, and by the time it is ready to prepare for marketing, the "worms" will have practically disappeared.

NATURAL ENEMIES ⁴

Several natural enemies of the celery leaf-tyer have been taken in the field, but usually they are not present in sufficient numbers to be of any consequence in controlling the "worms." Of the internal hymenopterous parasites found, *Rhogas rufo-coxalis* Cresson was the most common and *Campoplex phthorimaeae* Cushman was occasionally taken. It is probable that at times the egg parasite *Trichogramma minutum* Riley is quite effective.

WEATHER CONDITIONS

Development is much more rapid in warm than in cold weather. A common observation among the growers, confirmed by the writer's investigation, was that larvæ were much more plentiful and damage more severe during a warm, dry season than during one when rains came early and were followed by cool fall weather.

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⁴ See Chittenden (3) for a list of the parasites of this insect.

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Table 1.-- Maximum, minimum, and average length, in days, of the different life stages of the celery leaf-tyer for the four seasons of the year at Alhambra, Calif.

Stage	December, January and February			March, April and May			June, July and August			September, October and November		
	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.
Egg	30	14	20	20	15	17.	9	4	6	12	5	8
Larva	68	53	58	61	24	42.	27	21	23.5	44	20	29
Prepupa	10	4	5.5	4	2	3.3	3	2	2.3	4	2	3.2
Pupa	37	19	30	22	15	17	14	6	11	25	8	15.5
Egg to adult	145	90	113.5	107	56	79.3	53	33	42.7	85	35	55.7

Table 2.-- Average maximum, minimum and mean seasonal temperature at Alhambra, Calif., while the life history of the celery leaf-tyer as shown in Table 3 was being studied.

	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
Ave. Max..	65° F.			68° F.			88° F.			83° F.		
Ave. Min...	38			42			56			53		
Ave. mean	53			55			72			67		

TABLE 3.--CONTINUOUS-GENERATION SERIES OF THE CELERY LEAF-TYER

Generation	Eggs laid	Egg stage days	Hatched	Larval stage days	Prepupated	Pupal stage days	Adults emerged	Adults died	Adult stage days	Egg to adult days	Total length of life, days
1	7-4-18	7	7-11	24	8-4	9	8-15	8-24	11	40	51
2	8-17*	6	8-24	23	9-16	10	9-26	25		36	49
3	10-25	6	10-31	45	12-16	30	1-14	2-14	31	81	112
4	1-17-19*	14	1-31	62	4-2	17	4-19	4-25	6	99	105
5	4-22-19*	13	5-7	30	6-7	12	6-19			55	
6	7-13	6	7-19	23	8-12	6	8-18	9-23	36	35	71
		7				10	22	26	34	39	73

R A NEW RIPERSIA (HOMOP.) ATTACKING
WHEATBY R. W. DOANE AND J. B. STEINWEDEN
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While examining the roots of wheat in the dry farm region in Salt Lake County, Utah, in May, 1927, we found that a number of the plants were infested with a coccid which was more or less covered by a considerable amount of white, cottony secretion. Further examination showed that the insect was much more abundant on the roots of the common June grass which covers the uncultivated lands throughout this region and which was very abundant in this field of dry land wheat. This grass is doubtless the native host for this insect. The infestations are local. Small areas a few feet or a few yards in diameter may be badly infested while other plants, near by, may have none of the coccids on them.

In the areas where the June grass is badly infested many of the insects have gone over to the roots of the wheat; sometimes 75 to 80 per cent of the wheat plants in these infested areas showed some infestation. The field where these were first found had been uncultivated for several years previous to this and was entirely covered with June grass. It was poorly disced before the wheat was sown, so the grass is still very abundant throughout the field. It is too early yet to determine whether this species will prove to be of economic importance on the wheat. It is quite possible that as the grass ripens and dries, more of the insects may migrate to the roots of the wheat. If they become at all abundant on the wheat they may seriously affect the plants. The wheat in this dry farm region usually needs all of the moisture that its roots can gather and roots infested with such a sucking insect as this cannot properly perform their function.

As the insect is apparently undescribed a description follows:

Ripersia arenaria Doane and Steinweden, n. sp.

Adults covered with a considerable amount of white cottony secretion. Length on slide 2 to 3 mm. General form of body oval, somewhat elongate.

Antennæ short, six-segmented (figure F).

Leg short (figure E).

Derm with multilocular pores (figure B) and short, stout setæ (figure C) on both dorsal and ventral sides, more numerous on dorsum, especially in posterior region of body. A few small, scattered tubular ducts (figure D) on both ventral and dorsal sides. No triangular or quinelocular pores. A few scattered, long, slender body setæ down center of body and at posterior region, both dorsally and ventrally.

Cerarii absent.

Anal ring simple with six anal setæ arranged in two groups on each side (figure A). Only a few simple anal pores.

Anal lobes inconspicuous with only one long, slender, hair-like seta.

Type locality: On roots of June grass (*Bromus arenarius*), near Salt Lake City, Utah.

Type slide deposited in Stanford University collection.

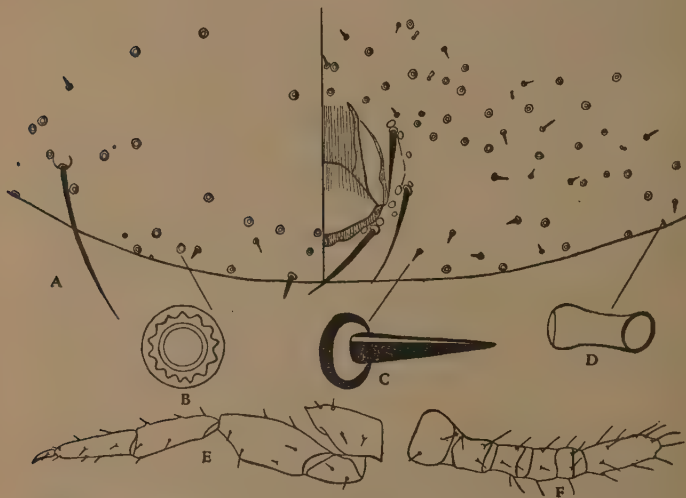


Figure A, posterior region of body; left, ventral side; right, dorsal side; figure B, multilocular pore; figure C, seta; figure D, tubular duct; figure E, leg; figure F, antenna.

Q SYNONYMIC NOTES (LEPID., ARCTIIDÆ)

BY WILLIAM BARNES AND F. H. BENJAMIN

Decatur, Illinois

Through the kindness of Dr. K. Jordan and Baron Rothschild, we have received a specimen of *Pygarctia oslari* Roths., and paratypes of "*Pygarctia*" *fusca* Roths., *Halisidota maculata texana* Roths. and *Hemihyalea argillacea* Roths. As the synonymy herein proposed is to be used in a "Bombycid" List we think it well to publish our version of the placement of these names.

"*Pygarctia*" *fusca* represents a species heretofore unknown to us. It appears to be a *Euchætias*; is as large, or larger, than *gigantea*; with color and maculation like *zella* save for the absence of the white discal dot of that species.

Pygarctia oslari appears to us to be only bleached out specimens of *murina* Stretch (*poliochroa* Hamps.), but pending receipt of further New Mexican material we prefer tentatively to retain the name as a race.

Hemihyalea argillacea appears to be rubbed *edwardsii*. In this regard, in material from a number of collections, we have found the names *edwardsii* and *labecula* transposed. We possess a specimen compared with the type of *edwardsii* (Mus. Comp. Zool.) and another specimen compared with the type of *labecula* (Snow Coll.), both comparisons made by Dr. McDunnough. Grote's original description of *labecula* points out that it is "less yellow than *edwardsii*, differing by the brownish thorax." Hampson, 1901, Cat. Lep. Phal. B. M., III, 131, pl. XXXIX, seems to have the two species correctly sorted. Holland, 1903, Moth Book, pl. XIV, f. 6, conveys the impression that *edwardsii* is darker than *labecula* which he puts as f. 7 of the same plate. We suspect his figure 6 simply represents a fresh specimen of the same species as his figure 7 and that both figures refer to *labecula*. True *edwardsii* is much more yellow on wing ground color and with a yellow thorax. The hyaline nature of the wings of both species seems mainly influenced by the amount the specimens have flown before being caught.

Halisidota maculata texana appears to us to be the same as *alni* Hy. Edw. There is a decided question in our minds if *alni* is distinct from *angulifera* Wlk., or if either differ enough from

eastern *maculata* for the names to be of any consequence. The species seems to enter Texas from the west via Colorado, Utah and New Mexico. We have not seen the species from the southeastern region between Texas and Pennsylvania. Eastern *maculata*, of which we possess specimens from Pennsylvania and New York north to Maine and Ontario is a very variable insect and includes within its range of variability specimens like typical *alni* and *angulifera*. The latter may, perhaps, represent an insular race (Vancouver Island) very slightly darker and brighter marked than typical *alni*, the differences decidedly obsolescent. We know of no way to sort *alni* from *maculata* save by the locality labels. We have *alni* from Mount Shasta, California (topotypical); Arrowhead Lake and Kaslo, British Columbia; Reed, Oregon; various California localities probably ranging as far south as Santa Cruz (E. A. Dodge); Reno, Nevada; Park County (Oslar), Gunnison County (Lindsey), Durango and Glenwood Springs, Colorado; Stockton and Provo, Utah (Spalding); White Mountains, Arizona (Lusk); Jemez Springs, New Mexico; Texas. The larva is said to be somewhat different from eastern *maculata*. The name *agassizi* Pack. appears applicable to a local race from the coast region of California with most of the maculation often more or less obsolescent leaving the reniform darker and contrasting, the ground color often deeper than in *alni*. We have it from Solano and Alameda counties, and what appears to be much the same thing from San Luis Obispo. We cannot comment on the exact status of *eureka* Dyar, described from *Eureka, California*. It has all the tendencies of *agassizi* for reduction of transverse maculation and the intensification of the reniform, besides being heavily brown-shaded along costa, inner margin, and on and distad of the reniform. The fringes of the wings are brown instead of yellow. The name may represent a distinct species, it may be racial, color form, or possibly may be based on aberrational specimens. Tentatively we retain it as a race. The name *indistincta* B. and Mcd. belongs in the *maculata* group of the genus and may represent either a distinct species or a race of *maculata*. It is known to us from the type ♂ only, locality Santa Catalina Island. It has been figured 1912, Contrib., I, (4), pl. XIII, f. 14. It appears to have darker fringes than normal for *maculata* forms with the exception of *eureka*,

and a different subterminal line. We are inclined to consider the name represents a valid but local species. Hampson, 1920, Cat. Lep. Phal. B. M., Suppl., II, 269, sinks the name to *bicolor* Wlk., but the type of *indistincta* does not even faintly resemble Hampson's figure of *bicolor* (1901, Cat. Lep. Phal. B. M., III, 151, pl. XL, f. 4).

ON THE IDENTITY OF ACIDALIA HEPATICARIA GN. (LEPID., GEOMETRIDÆ)

BY WILLIAM BARNES AND F. H. BENJAMIN

Decatur, Illinois

This species was described by Guenée, 1857, Sp. Gén., IX, 471. The specimen figured by Oberthür (f. 3421) is in the Barnes collection. It bears labels "Typicum Specimen," "Ex Musæo Ach. Guenée." This specimen is very probably the type. It is a *Scelolophia* close to *crossii* Hlst. *Xystrota rubromarginaria* Pac. (*ferruminaria* Zell., *rubromarginata* Pack.) is the oldest name known to us for the species heretofore going as *hepaticaria*; with *volucrata* Hlst. as the dark form.

ON THE IDENTITY OF "COSMIA" ORINA GN. (LEPID., PHALÆNIDÆ)

BY WILLIAM BARNES AND F. H. BENJAMIN

Decatur, Illinois

ELAPHRIA GRATA Hbn.

1818 ?, Hübner, Zutr. exot. Schmett., I, 16, No. 36, ff. 71-72, *Elaphria orina* Gn.

1852, Guenée, Spec. Gen., VI, Noct., II, 10, *Cosmia*.

rasilis Morr.

1874, Morrison, Proc. Bost. Soc. Nat. Hist., XVII, 158, *Hadena*.

‡*subusta* Auct. (nec Hbn.).

1899, Druce, Biol. Centr. Amer., Lep., Het., I, 290 (partim.), *Atethmia*.

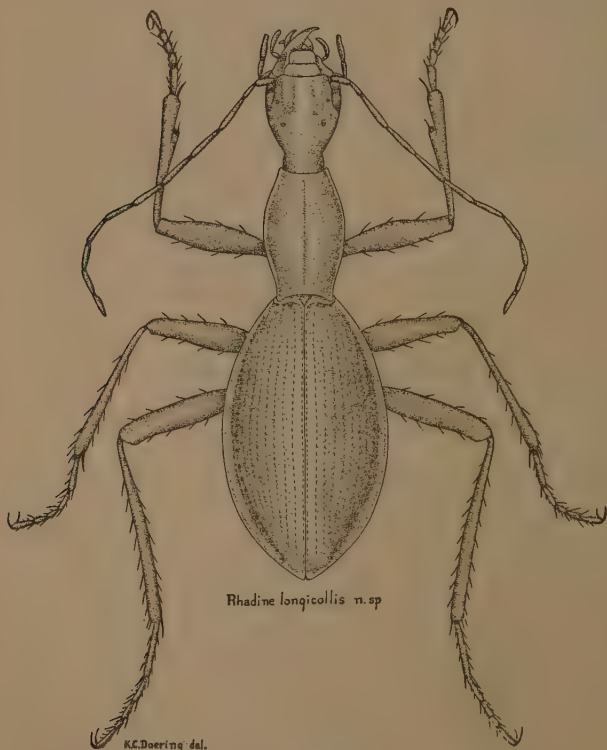
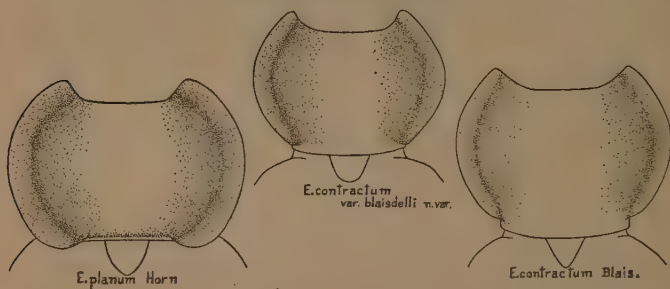
A specimen was received from the Oberthür collection bearing Guenée's label, "*Cosmia orina* Gn. Spec. 678 Amer. Septentr., Baltimore (Becker)."

This specimen, which is *Elaphria grata*, may be the type of *orina*. It agrees perfectly with the original description.

The species heretofore going under the name of *orina* does not agree with the original description.

R

Illustrations for
TWO INTERESTING BEETLES FROM CARLSBAD CAVERN
BY WARWICK BENEDICT



Rhadine longicollis n. sp

K.E. Doering del.

See Pan-Pacific Entomologist, Vol. IV, page 44.

R TABANIDS BREEDING IN RICE FIELDS

BY W. B. HERMS

Professor of Parasitology, University of California

Since the introduction of rice in California there has been an apparent increase in the number of horseflies (Tabanidæ) in counties where this crop is grown. The writer has consistently been able to collect Tabanid larvæ in roadside pools, the result of rice field drainage.

Recently an investigation of the rice fields of Colusa County was undertaken to ascertain the extent of horsefly breeding. This county is not only a large producer of rice, but is also an important dairy section, and many complaints have been received because of the punishment which dairy cattle suffer from the bites of numerous horseflies, particularly the large black and white species, *Tabanus punctifer* O. S. Anthrax is a very common disease in this county and recently cases of anaplasmosis have occurred in several of the dairy herds. Anthrax is known to be transmitted in part by Tabanids; to what extent, if any, anaplasmosis is transmitted by these blood suckers remains to be seen.

To be impressed with the seriousness of this problem one needs but visit a dairy in the vicinity of one of these great rice fields and observe the hordes of vicious flies at work on the cattle, and then strike out for the rice and note the numbers of flies flying hither and thither over the fields.

Characteristic egg masses of *Tabanus punctifer* were found in abundance (early August) adhering to the stems and blades of the rice and other aquatic vegetation. A number of these egg masses were collected and observed in the laboratory at Berkeley. The size of the dark gray-colored masses varies somewhat with the surface to which they are attached, i. e., on a narrow stem the mass in several layers may be somewhat more elongate, to about three-quarters inch, or it may be much more heaped up or wedge shaped. The number of eggs varies from about 200 to 300. The incubation period is approximately seven days. The spindle-shaped, 2 mm. long larvæ tumble out of the egg and fall upon the surface of the water (or mud) where they wriggle until the surface film is broken and they drop to the bottom and are soon lost in the mud.

The eggs appear to be invariably heavily parasitized. One extreme case alone may be cited. Two egg masses were placed in a shell vial covered with gauze, many egg masses were similarly treated and large numbers of hymenopterous egg parasites reared, but in the case of the two egg masses 561 resulted and not a single Tabanid larva emerged. With the number of adult flies already so abundant one might well imagine the extent of a horsefly plague if the present degree of parasitism were largely reduced.

How long the larva remains in this stage is unknown, but two stages, half grown and full grown, were collected in the bottom muck along the edges of the rice fields at the time stated. In this stage they are strongly predaceous and cannibalistic. The full grown, yellowish white, spindle-shaped larva measures about 4 cm. ($1\frac{1}{2}$ inches) in length and 6 to 7 mm. in diameter. The full-grown larva leaves the water or muck and enters the moist soil at the edge of the rice field (or along the checks) where it pupates at a distance of from four to five inches from the surface. The pupæ are highly spinose, each abdominal segment being provided with a circlet of spines near the apex. In size the pupæ are somewhat shorter than the full-grown larvæ, much more plump with the head end distinctly pupa-form.

Emergence of the adult is effected in a few days, apparently but six to seven, the exact time was not observed. The pupa case splits dorsally much after the fashion of a Cicada. There stands before me on my desk a newly emerged female *Tabanus punctifer* which although it was given the opportunity to feed on a cow, even with the skin punctured to allow blood to exude, remains stubbornly in a fast. We still have much to learn, if we are to succeed well in transmission experiments.

Dr. E. G. Titus writes us that he now represents the Gebrüder Dippe, of Quedlinburg, Germany, in the United States and Canada, and that his business address will be 416 Beason Building, Salt Lake City, Utah.—Editor.

R A NEW SPECIES OF MICRIXYS (COLEOPTERA-
CARABIDÆ)

BY EDWIN C. VAN DYKE

University of California, Berkeley, California

Micrixys mexicanus Van Dyke, new species

Robust, black, antennæ, mouth-parts and legs ferruginous, outer segments of antennæ and palpi somewhat piceous; elytra an orange red with narrow basal margin, a broad fascia slightly behind the middle, dilated at the suture and not reaching the margin, and a triangular patch at apex, broadest at suture, black. Head broadly sulcate anteriorly, clypeal margins lobular and well elevated above the base of antennæ, frons somewhat shining, and irregularly punctured. Prothorax not quite twice as wide as long, anterior margin transverse, sides broadly arcuate, widest just back of middle, hind angles sharply dentate and divergent, disc slightly convex, shallowly canalicate and very coarsely, somewhat confluent, punctate. Elytra oval, somewhat over three-fifths as wide as long, convex, striæ well defined and coarsely, regularly punctured, intervals distinctly convex and prominent, the sutural and first less so, the second most prominent, all very finely and irregularly punctured. Beneath with entire thorax and sides of abdomen coarsely punctured, the abdominal segments at middle somewhat smooth and finely punctured. Length, 8.5 mm.; breadth, 3.75 mm.

Type, a unique female (No. 2468, Mus. Calif. Acad. Sci.), in my collection, secured near Venedio, Sinaloa, Mexico, June 16, 1918, by Mr. J. August Kusche and by him kindly presented to me.

This species, the second to be discovered in the genus, is readily separable from the type species, *Micrixys distinctus* (Hald.), by being slightly larger and proportionally broader, with a different color pattern, the black head and prothorax especially contrasting with the rufous head and prothorax of the other, the clypeal margins more developed, the posterior angles of the prothorax distinctly more prominent and divergent, and the elytral striæ and intervals clearly defined and with an irregularity as to prominence of the inner intervals.

A PALMACORIXA FROM MEXICO (HEMIPTERA,
CORIXIDÆ)

BY H. B. HUNGERFORD

University of Kansas, Lawrence, Kansas

The genus *Palmacorixa* was established by Dr. Abbott¹ for a new Corixid which he described from Fort Collins, Colorado, under the name *Palmacorixa gillettii*. The genus is valid, but the author's characterization of it a little unfortunate, because the metathoracic wings are not aborted in both sexes in all cases and his description of the pala of the male is specific and not generic. The following year he described *P. bucnoi* from New York. Since that time these species have been reported from other states. I collected both of them from the same pond in Minnesota. The following species from Mexico collected by my friend, Dr. A. Dampf, is new.

Palmacorixa mexicana Hungerford, sp. new

Size: Length 4.85-5.00 mm. Width of head 1.45 mm., which is equal to greatest body width. In the male specimen at hand the head is .7 mm. long; pronotum .5mm.; elytral suture 1.9 mm.; distance from tip of clavus to tip of membrane 1.75 mm.

Color: Vertex of head with longitudinal median brown stripe, brown dot on interocular space near the base of each eye, caudal margin of head brown; pronotum crossed by half a dozen narrow, more or less broken, pale lines; clavus crossed by furcate and broken pale lines, basal ones much broader than those of distal half which are thin, broken and anastomosing, as is also true of corium and membrane; embolium dark on basal half; face, limbs and venter pale, but more or less embrowned.

Structural characteristics: Frontal depression on head of male large attaining the eyes laterally and surpassing them dorsally, front margin of vertex produced, faint median longitudinal carina ending in the caudally produced rear margin of the head. Interocular space both front and rear less than width of an eye; pronotum, narrow, short, surface roughened. Metaxyphus normal in shape. Anterior femur of male incrassate, produced on inner base and bearing a large stridular area; tibia carinate on front side with white fleshy disc on distal end; pala with outer margin produced and incurved; pegs in two rows, one row of large pegs (four) along the lower margin, another crescent-shaped row above, of ten pegs. The long anterior tibia and the short triangular pala with its peg arrangement

¹ Ent. News, Vol. XXIII, p. 337.

somewhat resembles those of *A. mercenaria* (Say). Strigil on right side nearly circular and composed of six rows. Second pair of wings appear to be aborted in these specimens.

Described from a male and a female taken in the Xochimilco-Sea, Mexico, D. F. August 3, 1924. By Alf. Dampf.

Holotype and allotype in collection of H. B. Hungerford.

KALOTERMES MINOR (Hagen)

This very destructive termite, which works in dry wood and does not need a ground connection like most other termites, has recently been observed to have thoroughly honeycombed the old redwood timbers of one of the bastions of old Fort Ross, built by the Russians in 1812, near the mouth of the Russian River in Sonoma County. The redwood normally is moderately resistant to termite attacks, but in this case has, no doubt, had much of its tannic acid leached out through long weathering, and thus has lost its resistance.—Edwin C. Van Dyke.

UNCOMMON BUPRESTIDÆ

Acmaødera cuprina Spin. This greenish metallic beetle, normally found in Mexico and the West Indies, has been questionably kept on the list of United States Coleoptera on the strength of a single specimen supposedly taken in Texas. It may now be definitely retained, for on October 8, 1927, Miss M. E. McClelland, Assistant Curator of Ornithology and Mammology of the California Academy of Sciences, caught a specimen in Madera Cañon, Santa Rita Mountains, Pima County, Arizona.

Acmaødera kaupii Thom. A specimen of this rare species, not seen by Waterhouse, who studied the material for the Biologia Centrali-Americana, was taken by a friend of mine, Mrs. Mexia, while botanizing, January 1, 1927, near Sebastian, Sierra Madera Mountains, altitude 1800 m., Jalisco, Mexico. Both specimens are now in the collection of the California Academy of Sciences.—Edwin C. Van Dyke.

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E. P. VAN DUZEE, Editor.

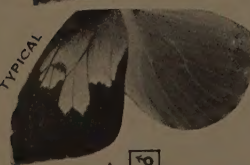
S. B. FREEBORN., Treasurer

EDITORIAL COMMENT

Entomological work on the Pacific Coast has been, and to quite an extent still is, the pioneer work of describing the new species. This is foundation work and has to be done before synoptical, faunal and monographic work can be undertaken. In the East this work has advanced to where they are now producing most excellent faunal treatises such as the Butterfly and Moth books of Dr. W. J. Holland; Blatchley's books on the Coleoptera, Orthoptera and Hemiptera; the Connecticut books on Hymenoptera, Hemiptera and Odonata, and the New York volume on the microlepidoptera. In the West the butterflies are well covered by the beautiful books by W. G. Wright and J. A. Comstock, but our insects of other orders are still in process of description. In the work of collecting and describing the new species the California Academy of Sciences has taken a prominent place. In the pages of its three publications, the *Proceedings*, *Occasional Papers* and the *Bulletin*, there have been described seventy-six new genera and 2063 new species of insects, while in the pages of the *Pan-Pacific Entomologist* have thus far appeared the descriptions of twenty-six new genera and 312 new species. In some of the orders of insects there are still many undescribed species to be discovered in our western fauna, but we are nearing our goal where useful faunal books can be produced, when competent students with the necessary leisure can be found to do the work.

A most interesting journal letter from Mr. C. L. Fox tells of his safe arrival in England after a most delightful voyage direct from San Francisco to London by way of the Panama Canal. He was looking forward to an early resumption of his studies in the genus *Nomada*, on which he was engaged when he left San Francisco.

TYPICAL



♂



A



B



C

form ♂- bernardino Edw.



TYPE

form ♂- lineacincta Gun.



♂

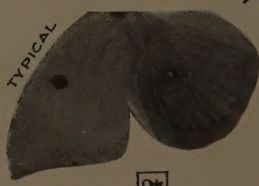
TYPE



♀

tr. f.- fanniae Gun.

TYPICAL



♀



1



2

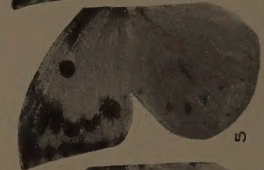


3



4

"X"



5



6

TYPE

form ♀- masmbrosus Gun.

species-
Zerene
eurydice Bvd.



TYPE

form ♀-
immaculata Gun.

"X"



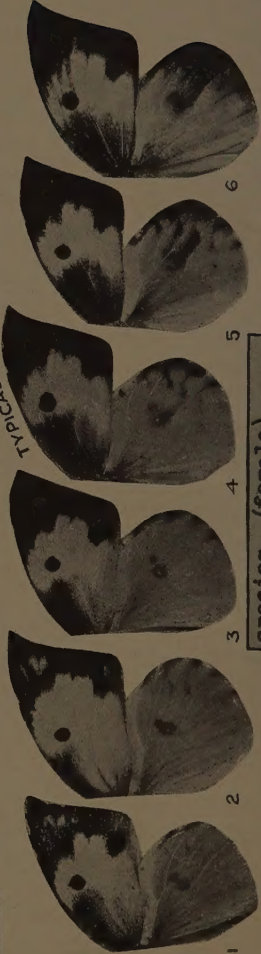
PARATYPE



TYPICAL

species- (male)
Zerene caesia Stoll.

TYPICAL



species- (female)
Zerene caesia Stoll.

Zerene caesia Stoll Plate II.